

CHUG AND DYNAMICS OF THE RS-84 SUBSCALE PREBURNER

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ABSTRACT

The development of the RS-84 engine began in 2002 as part of the Space Launch Initiative. It was intended to be a reusable liquid oxygen/RP-1 booster engine of approximately 1 Mlbf thrust. Part of the test campaign consisted of testing subscale components to study key technologies such as oxygen-rich, liquid oxygen/RP-1 combustion. In late 2003, the subscale preburner completed 4 hot-fire tests at Stennis Space Center with various hardware configurations and operating conditions, but before all planned tests could be completed the RS-84 engine development program was canceled in 2004. Recently, there has been a renewed interest in the development of an oxygen-rich, liquid oxygen/RP-1 combustion engine. Aerojet Rocketdyne and NASA completed testing of the subscale preburner in 2014 at Marshall Space Flight Center in an effort to better understand the chug encountered during the 2003 testing and to collect performance information over a wider range of operating conditions. The 2003 and 2014 data sets included extreme chug oscillations that reached nearly 200% of the chamber pressure and were reduced to well below 10% of the chamber pressure by incorporating a fuel orifice upstream of the fuel manifold. Depending on the hardware configuration and operating condition, a wide range of chug oscillation amplitudes were encountered. The dynamics for both test series were characterized and the data were used in the development of a chug model.